codings are 10n, 103(n), 103z, and .01. Similarly, 22n or 223 are both .022uF.

For values of 100,000pF to .999uF. Again, 104 is a common marking for 0.1uF, but you will also find 100n equally as often. Just ".1" is found, or sometimes Ou1. The latter is a similar convention to resistors where the "u" symbol is like the "R" symbol, in this case showing the position of the decimal point in relation to 1uF. 220n would be the same as .22uF.

Above 1uF (more often an electrolytic type) the actual value is generally printed accurately. but often followed by the voltage, again usually with a "v" following it. You may sometimes find say, 10/16 — this would be 10uF at 16v working.

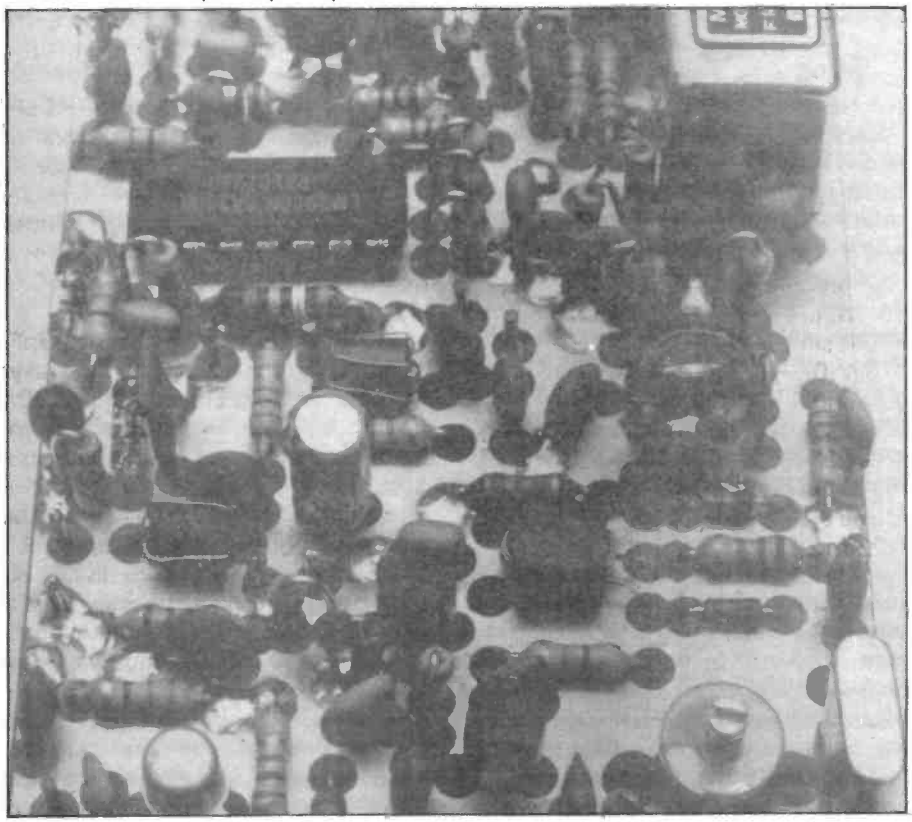
Capacitor voltages

The subject of 'working voltages' and electrolytic capacitors often seems to confuse people. Let us assume that the article you are following specifies a "16v working" device. Now, it doesn't matter one little bit if you put in a capacitor that has a working voltage of anything ABOVE this, say 25V, 50V or even 1000V (if you had one). The only possible problem is that the higher working voltage type will probably be physically larger, and may not fit the layout. Again, although radial types (where both leads come out of one end of the can) are usually used on PCBS, you can use axial types (one lead at each end) by up-ending them and bringing the other lead round the body.

Types of capacitor

The most common workhorse of the lot is the **ceramic** type. For non-critical applications, such as decoupling of RF circuits and many interstage coupling and resonating purposes, these are fine, providing their limitations are borne in mind. **The disc type** (i.e. round in shape) **are most common in the larger values (10n and above)**, and come in a variety of shapes! For 10n and above, except for some specifically marked as high voltage, their working voltages, because of their small size and high capacity, are limited to 20 to 63V. Capacity tolerance is usually +/− 10%, +/− 20%, or +80/−20% (usual codes for these are K, M or Z — often in lower case — following the figures). Such large tolerances don't really matter for decoupling purposes, but bear it in mind if you happen to need something fairly accurate. The reason for the large tolerances is the form of dielectric used to get the size/capacity relationship down.

Short component lengths above the PCB are essential in RF construction to ensure stabilty and peak performance.



Disc types also come in lower values down to 1pF — an additional tolerance letter of J (+/−5%) is usual here, and you are unlikely to find a Z tolerance on these types.

With values of 1000pF and below, the ceramic plate or plaquette type are common. These are square in shape, and usually very small — a 2p2 capacitor can be very little different in size to a 1000pF, with a working voltage of 63V max. As these are so much more commonly used in RF tuned circuits, the temperature coefficient becomes more important. This is usually denoted by a coloured band across the top of the capacitor, or by a patch of colour on one corner. The usual colour code is:

RED/VIOLET	P100
BLACK	NP0
ORANGE	N150
YELLOW	N220
GREEN	N330
BLUE	N470
VIOLET	N750
ORANGE/ORANGE	N1500

N = Negative coefficient
P = Positive coefficient
Figure = capacitance change in ppm per deg/C.

Capacitors without colour markings are not selected and may lie anywhere in this range. Using combinations of these marked types can give suitable temperature compensation to most circuits.

Again, different dielectrics are used for the higher capacities. The changeover point varies, but above 330pF Hi-K types are often found which aren't really suitable for use in tuned circuits.

Monolithics

One other type of ceramic often met, especially for decoupling purposes, are those of monolithic construction. They are made from alternating layers of ceramic dielectric materials — mixtures of fine ceramic powders and resins, together with silk-screened layers of metal paste electrodes. After further processing, stacking and compacting, they are cut into squares, and provided with wire ends and a tough encapsulation. This gives a lot of capacity in a small space, and although expensive by comparison to other ceramic types, are widely used in decoupling applications where space is limited.

Markings are usually limited to the